

SECTION 4

RESOURCE CAPACITY PROJECTION

Resource Capacity Projection provides an indication of the ability of the Deep Space Network to support the requirements of the current and planned mission set from a resource point of view. The resource view is obtained by determining the utilization on each individual antenna within a subnet. Utilization is defined as a percentage ratio of the number of planned hours to the total number of available hours for a DSN antenna and/or subnet resource.

The Near-term Capacity Projection from 1999 through 2001, as shown in Figures 14, 15, and 16 (supported by their respective a-f backup charts), takes a monthly look at each of the Deep Space Network subnets in terms of the utilized capacity (grey bar) and available capacity (white bar). The absolute height of the bar defines the total capacity available for scheduling in any particular month.

The Long-Range Resource Capacity Projection Summary for 2002 through 2008 (Figure 17) views the trends for each of those same subnets on a yearly basis.

All available times greater than one hour have been included in the available hours calculation. Maintenance has also been included within the planned schedule. Since requested support time is viewperiod dependent for each mission, just because there are hours available does not guarantee that support for a particular mission and/or event can be scheduled.

The total number of hours available per month for each subnet was calculated based on the total wall clock hours available per week after taking into account the current resource implementation schedule (as shown on backup charts a-f for Figures 14, 15, and 16). Each antenna has 168 hours per week available before any commitment to a user. The sum of all available hours for each subnet is indicated as available capacity above the zero line. The sum of all hours that have been planned by the resource allocation process is the utilized capacity below the zero line.

4.1 70-METER CAPACITY PROJECTION

4.1.1 1999-2008 Summary

The greater capacity utilization on the 70M subnet attests to the fact that the user base on the 70M subnet has the ability to take advantage of tracking gaps greater than an hour but less than the normal eight-hour pass that is spacecraft viewperiod independent. This is particularly true for programs that use the network as an instrument for science, such as Radio Astronomy and Solar System RADAR.

The characteristic high average capacity utilization on the 70M subnet begins to show large fluctuations in 2002. From a high of 60% to 80% at the beginning of the year, all three complexes drop to the 30% to 40% range by the end of the year. Similar fluctuations occur in 2003 and 2004, with DSS-63 demonstrating high peak utilization in each year. Beginning in 2005, the capacity utilization on the subnet remains fairly flat and underutilized at a yearly average of between 26% and 32%. In general the Goldstone 70M appears to have the greatest average utilization, apparently due to its ability to support solar system RADAR activities on a non-interference basis.

4.1.2 Near-Term Projection (1999-2001)

1999, Figure 14a: The load on the 70M subnet is the heaviest of all the DSN resources in 1999. The monthly utilization capacity of the 70M subnet is continually at or above 70% for the entire year. In particular, the 70M antenna at Goldstone is at a 78% or greater throughout the year with an average load of 81%. The profile of the load at Canberra and Madrid is slightly less than at Goldstone, with an average of 78%. The average monthly remaining capacity of one hour or more at Goldstone is on the order of 121 hours. The Madrid and Canberra 70M antenna is characterized by a monthly average available capacity of 160 hours each.

2000, Figure 15a: The 70M subnet continues to be heavily used in 2000, with a capacity utilization starting at a peak 80% in January and staying above 50% throughout the year. The loads on the Goldstone and Madrid antennas track closely throughout the year, decreasing to a utilized capacity of just over 50% in December. The Canberra antenna experiences a jump in utilization to 95% during the last two months of the year.

2001, Figure 16a: In 2001, the capacity utilization on the individual antennas of the 70M subnet do not correlate well with each other. Although the average monthly capacity utilization is in the mid- to high-70% range at the beginning of the year, it drops to the 45% range at the end of the year. The Goldstone and Canberra antennas begin the year at capacity utilizations of 72% and 95%, respectively, but drop off to the 36% and 23% range, respectively, by November. On the other hand, the Madrid antenna capacity utilization grows to

95% in August and September and remains within the 80% range for the rest of the year.

4.2 34-METER HEF CAPACITY PROJECTION

4.2.1 1999-2008 Summary

The capacity utilization characteristic on the 34H subnet is distinguished by a profile in which the loads on the antennas at Goldstone and Madrid consistently track each other through 2005. At the same time, the Canberra 34H antenna consistently demonstrates a capacity utilization of 10% to 20% higher. The utilization profile also shows that Canberra has the greatest utilization, with Madrid second, and Goldstone last. The yearly average utilization on the subnet is 66% to 70% through 2007, falling to 54% in 2008. The 34H subnet is a well-utilized resource, with possibly 10% to 20% available capacity at the Madrid and Goldstone complexes.

4.2.2 Near-Term Projection (1999-2001)

1999, Figure 14b: In 1999 there is very little load disparity between individual antennas of the subnet. In particular, the subnet is equally loaded in the first four months of the year, with Canberra capacity utilization remaining high through September. The average capacity utilization at Madrid is 70% and at Canberra, 75%. The average capacity utilization at Goldstone is around 70%.

2000, Figure 15b: The capacity utilization on the Canberra antenna is at its greatest, reaching a peak of 97% in July, with an average yearly load of 83%. The loads on the Goldstone and Madrid antennas correlate with each other very closely at an average of 56%. The subnet capacity utilization is biased by the demands on the Canberra antenna, but has a yearly average of 65%, with a monthly high of 75% in July and a low of 53% in January.

2001, Figure 16b: The 63% capacity utilization on the HEF subnet is biased by the high utilization at DSS-45, average of 79% for the year. The Goldstone and Madrid HEF antennas are under utilized at 50% for the first three quarters of the calendar year. In the last quarter, Goldstone remains unchanged, however Madrid's utilization increases to 70% by December.

4.3 34-METER BEAM WAVEGUIDE 1 CAPACITY PROJECTION

4.3.1 1999-2008 Summary

In the first few years, the load on the subnet is fairly evenly distributed among all three antennas of the subnet. The load on the 34B1 subnet is distinguished by a capacity utilization for each antenna of 50% or greater through 2005. In 2006, the utilization for Madrid and Goldstone falls below 50%, while during the subsequent years all subnet resources fall below 50% utilization. As was the case with the 34H antennas, the Canberra antenna is consistently the highest utilized resource. The yearly average subnet utilization is between 63% and 68% through 2005. The utilization declines to 50% in 2006, with a sharp fall to 31% and 29% in the following two years.

4.3.2 Near-Term Projection (1999-2001)

1999, Figure 14c: The load on the first beam waveguide subnet is evenly distributed among all antennas of the subnet. The average capacity utilization for the year for each antenna is between 63% and 70%. The subnet average is on the order of 68%. The month with the greatest utilization is January with 84% at DSS-54. On a weekly basis, the lowest utilization is during March at DSS-54, with a utilization of 36%. Peak utilization for DSS-24 (89%) and DSS-34 (86%) occurs during May. Peak utilization for DSS-54, at 92%, occurs during August.

2000, Figure 15c: The load remains fairly evenly distributed throughout the year, with the average monthly capacity utilization greater than 50% for all antennas of the subnet. The greatest sustained utilization occurs at DSS-54, which exceeds 80% weekly capacity utilization from weeks 16 through 28. The subnet average utilization for the year is 66%.

2001, Figure 16c: The general profile for all the antennas of the subnet is peak utilization during the middle of the year, June and July. All antennas have monthly utilizations of greater than 50%, with DSS-24 at 91% for June and July. The yearly average for each of the antennas is between 73% and 77%, with a subnet yearly average of 75% at a monthly standard deviation of 224 hours, or 10% of available hours.

4.4 34-METER BEAM WAVEGUIDE 2 CAPACITY PROJECTION

4.4.1 1999-2008 Summary

The 34B2 antenna, DSS-25, is characterized by large utilization fluctuations throughout the entire period, 1999 - 2008. The exception is the relatively flat utilization in 2000, with yearly average utilization on the order of 23%, which followed 1999 with an average of 49%. Yearly average utilization picks up again in 2001 with 40%. The yearly average capacity utilization from 2002 through 2004 is only between 20% and 30%. In 2005 and 2006, the yearly average goes up to between 43% and 47%, falling to 32% in 2007 with a bottom of 19% in 2008. The growth in utilization during 2005 and 2006 is due to the Cassini tour.

4.4.2 Near-Term Projection (1999-2001)

1999, Figures 14d: Beam Waveguide Subnet 2 consists of a single beam waveguide antenna at the Goldstone complex, DSS-25. The average yearly capacity utilization in 1999 is 49%, with a peak utilization of 84% occurring in June. By November, the utilization drops below 50%. DSS-25 capacity utilization does not exceed 50% again until December of 2001. Generally, DSS-25 is an under-utilized resource.

2000, Figures 15d: DSS-25 enters the year with a peak capacity utilization of around 40% but rapidly declines to around 10% by February. A mid-year peak of 30% in June rapidly returns to the 10% neighborhood by August. A variable growth in the use of DSS-25 beginning in October brings the monthly utilization above 30% at the end of the year. DSS-25 remains an under-utilized resource.

2001, Figures 16d: DSS-25 monthly capacity utilization is below 50% until late November and December. At that time, weekly utilization grows rapidly and reaches a weekly peak exceeding 80% at the beginning of December. In general, DSS-25 remains an under-utilized resource.

4.5 34-METER HIGH SPEED BEAM WAVEGUIDE CAPACITY PROJECTION

4.5.1 1999-2008 Summary

Strongly focussed on supporting HEO missions, the utilization of the 34HSB antenna is moderate during the 1999 through 2001 time frame, while the ISTP missions remain active. The yearly average utilization in 1999, 2000, and 2001 is 52%, 45%, and 44%, respectively. Following the last ISTP mission end date in late 2001, the 34HSB antenna was not included in the utilization for

the remaining years because of pending decisions about structural and electronics upgrades.

4.5.2 Near-Term Projection (1999-2001)

1999, Figures 14e: In the first half of 1999, the capacity utilization averages around 60%. It falls below 60% in July and never exceeds 60% for the remainder of the near term three-year window. The total capacity utilization for 1999 is about 52%. The HSB antenna is not being fully utilized and has available capacity of around 300 hours per month for this entire period.

2000, Figures 15e: The capacity utilization is consistently within a few percent of 53% from March through September, with a decline to 26% by November. The yearly capacity utilization average is within a percent of 44%. On a weekly basis, the utilization of the HSB falls below 50% in week 41 of year 2000 and does not return to above 50% until week 16 of the following year. As was the case for 1999, the HSB antenna is not being fully utilized and has available capacity on the order of 300 hours per month for this entire period.

2001, Figures 16e: DSS-27 remains focussed on providing support to HEO missions. Capacity utilization is within 40% for the first three months and last five months of the year, with a peak of 56% in June. The year capacity utilization is around 45%. The HSB antenna is not being fully utilized and has available capacity of about 300 hours per month.

4.6 26-METER CAPACITY PROJECTION

4.6.1 1999-2008 Summary

With average yearly subnet utilizations of 50% in 1999, 43% in 2000, and 46% in 2001, the 26M resource is under-utilized throughout the near-term period for HEO missions included in the RAP baseline mission set. The real utilization is most likely much higher since these numbers do not include low earth orbiters, reimbursable support, and launch and early orbit phase support.

Capacity utilization of the 26M subnet is characterized by relatively high utilization on the Goldstone antenna and very little utilization on the remaining antennas. Most HEOs finish their extended mission by the close of 2001 and the utilization of the subnet is reduced. Aside from supporting HEO missions that have been included in the long-range planning process, the 26M subnet supports launch and early orbit phases of missions, reimbursable missions, and a small number of routine LEO missions. The long-range planning does not include these missions, therefore the utilization on the 26M subnet as presented in Figure 17 is not an accurate picture. Missions represented on the 26M subnet for long-range planning during this time frame are Cluster II and Integral, which are predominantly supported by the Goldstone antenna.

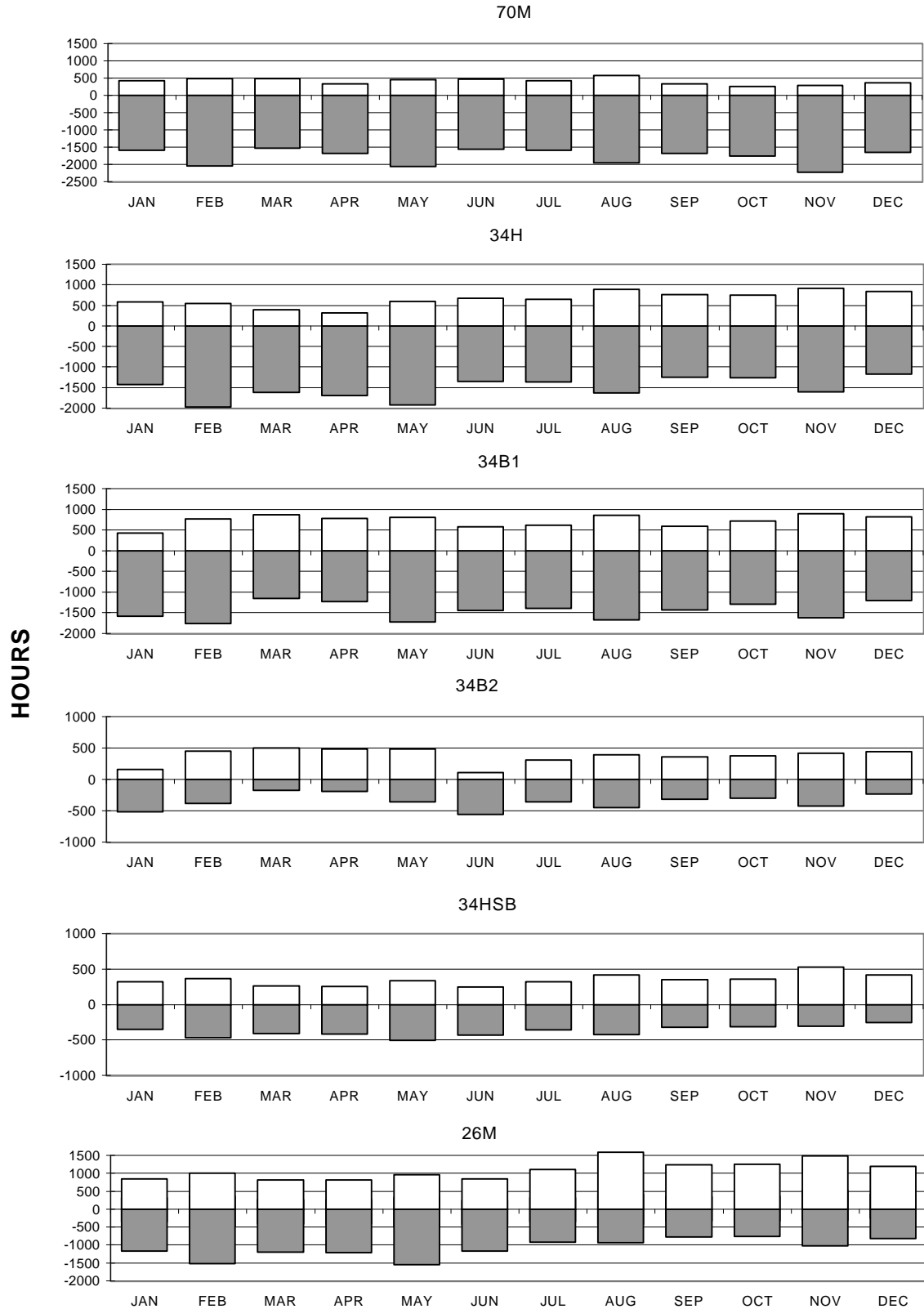
4.6.2 Near-Term Projection (1999-2001)

1999, Figure 14f: The 26M subnet is not evenly utilized during 1999. The Goldstone 26M antenna, DSS-16, is utilized at an average of 45% for the entire year. DSS-46 at Canberra has a greater utilization at the beginning of the year, on the order of 60%, but falls below 30% in July and remains in the 20% range for the remainder of the year. The greatest capacity utilization is obtained at the Madrid antenna, DSS-66. It remains 70% utilized for the first six months, then drops to the 45% range for the following 6 months.

2000, Figure 15f: The antennas of the 26M subnet are more equally utilized in 2000, however, the yearly average utilization for all the antennas of the subnet is below 50%. DSS-66 in Madrid has the greatest utilization at around 60% in March through May. The Canberra antenna is the least utilized, dropping to a range of 24% in June through September.

2001, Figure 16f: Canberra remains the least utilized antenna of the subnet, with a yearly average capacity utilization of 34%. The Goldstone antenna utilization increases to 60% in May and remains in that range for the remainder of the year. The capacity utilization of the Madrid 26M station peaks at 66% in June, but trails to the 40% range at the beginning and end of the year.

MONTHLY SUBNET CAPACITY PROJECTION 1999



Unshaded Area = Available Capacity
Shaded Area = Utilized Capacity

Monthly Subnet Utilization 1999

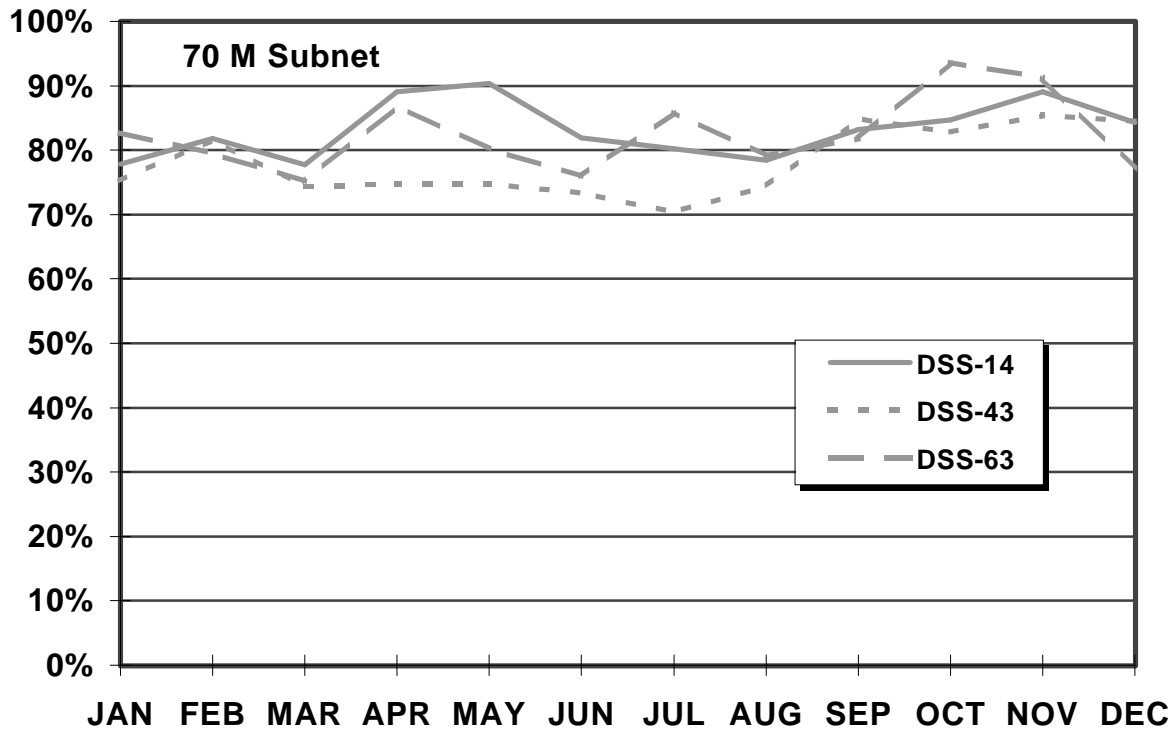


Figure 14a

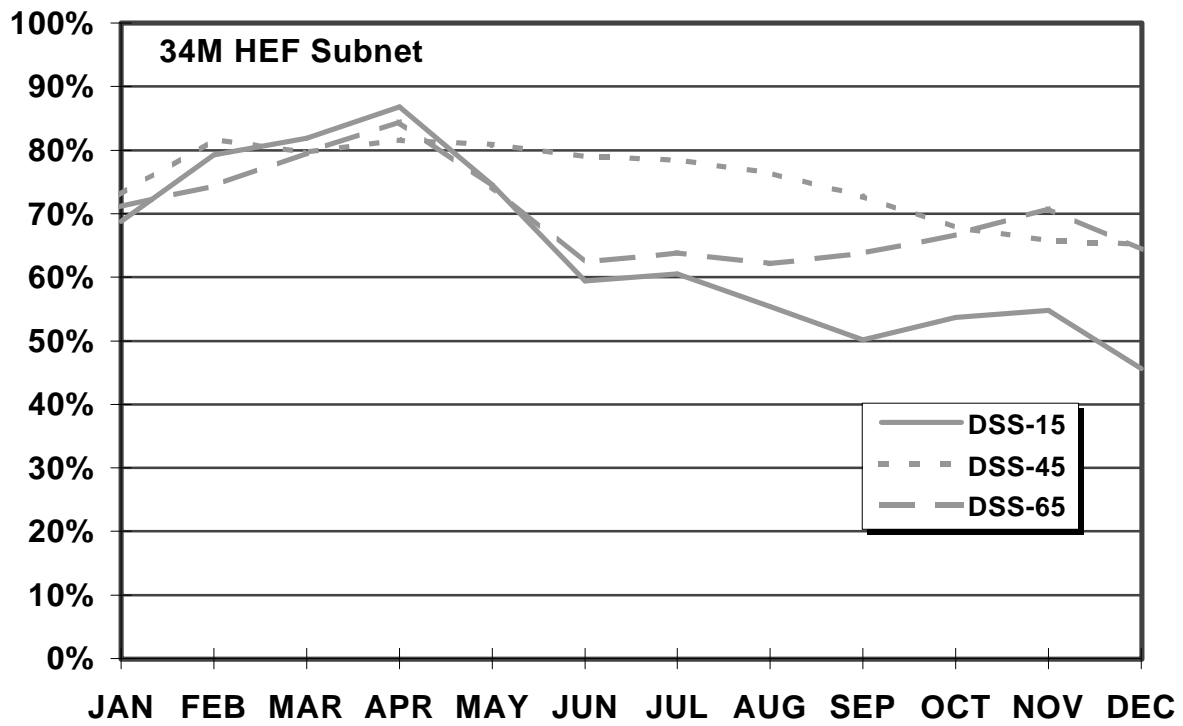


Figure 14b

Monthly Subnet Utilization 1999

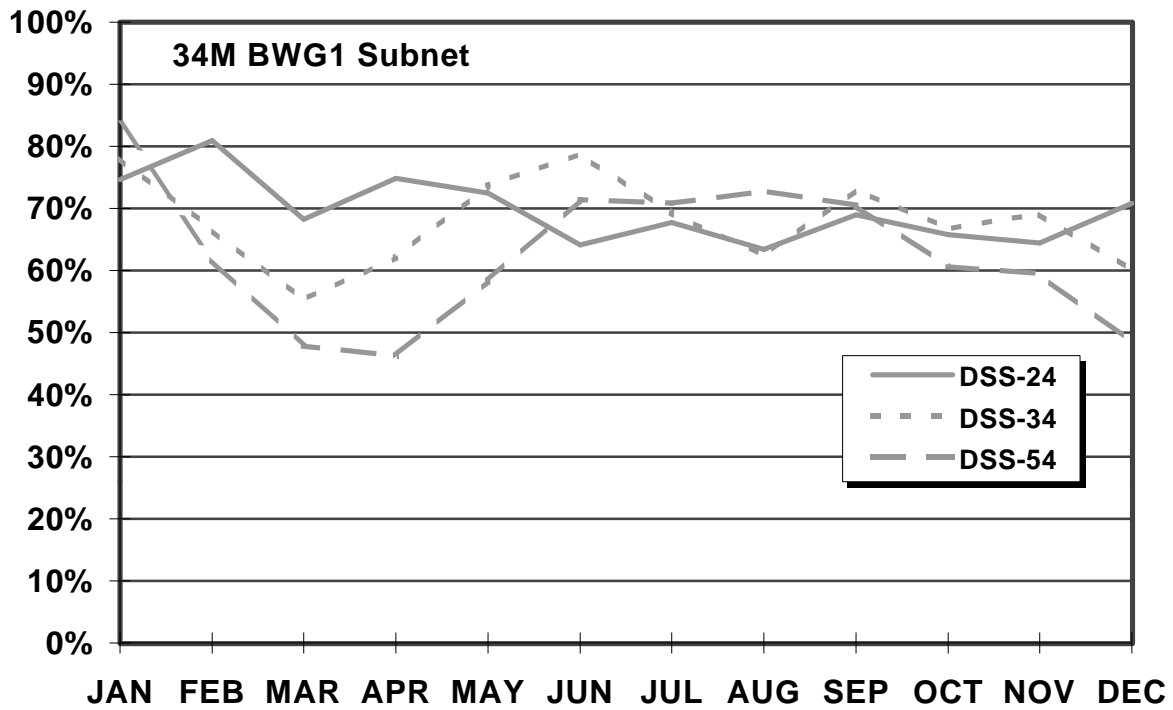


Figure 14c

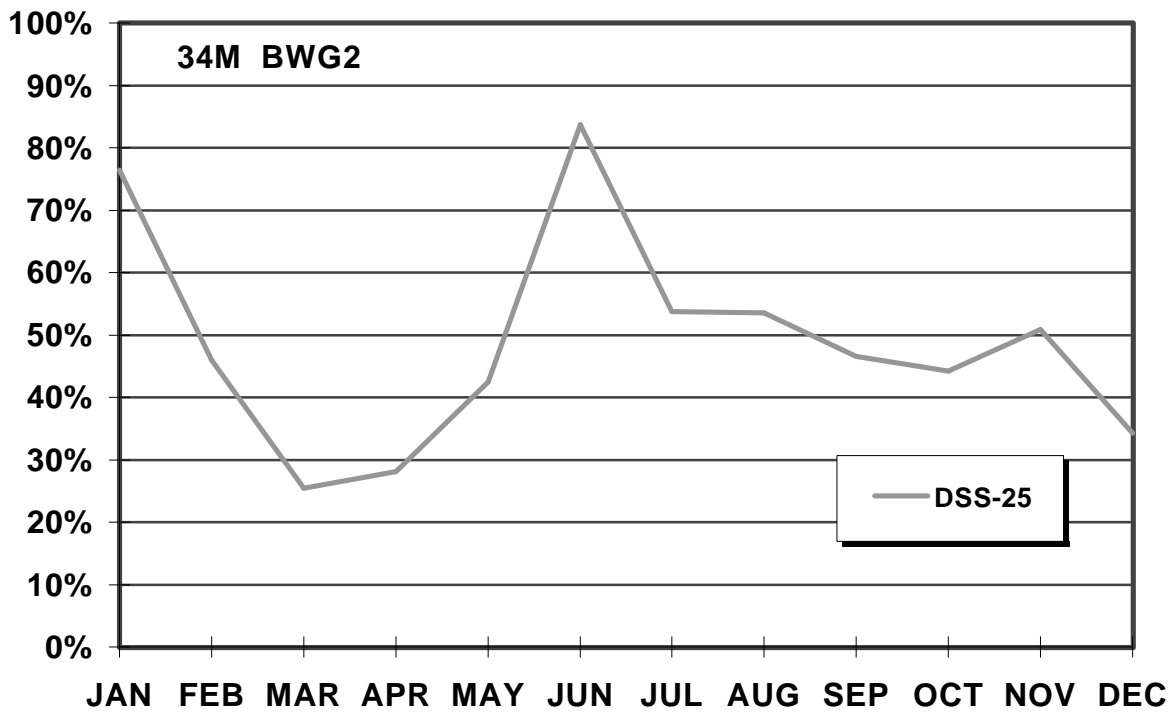
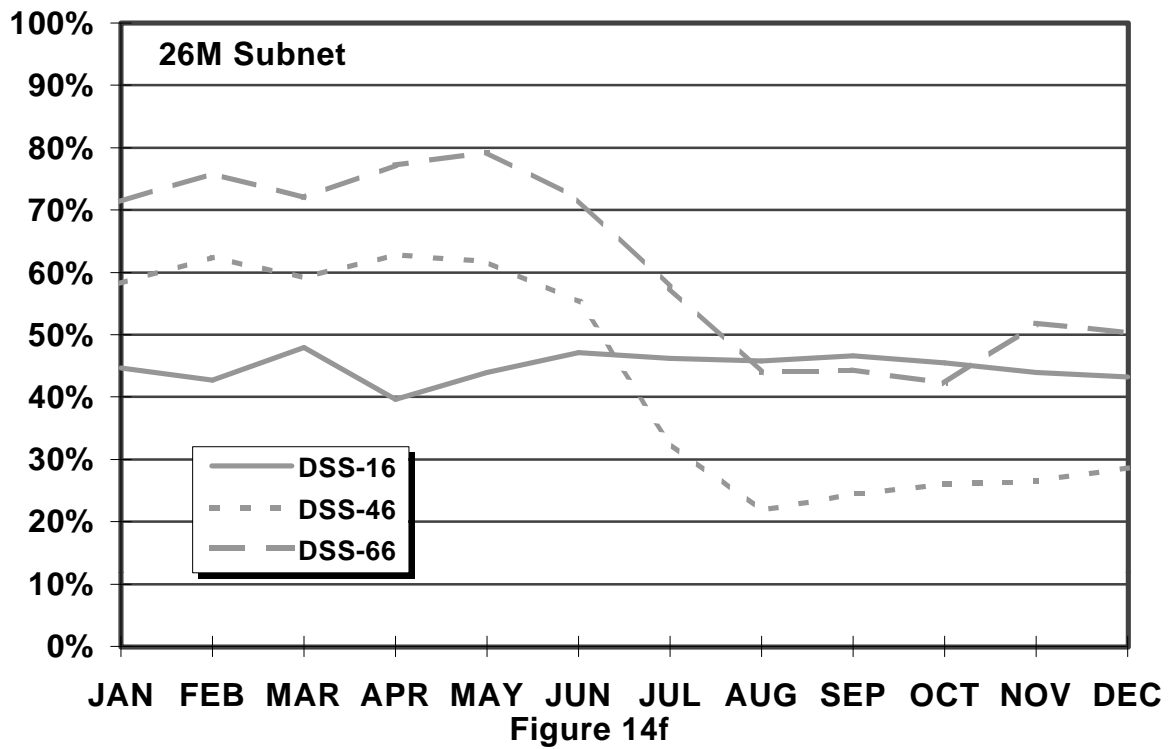
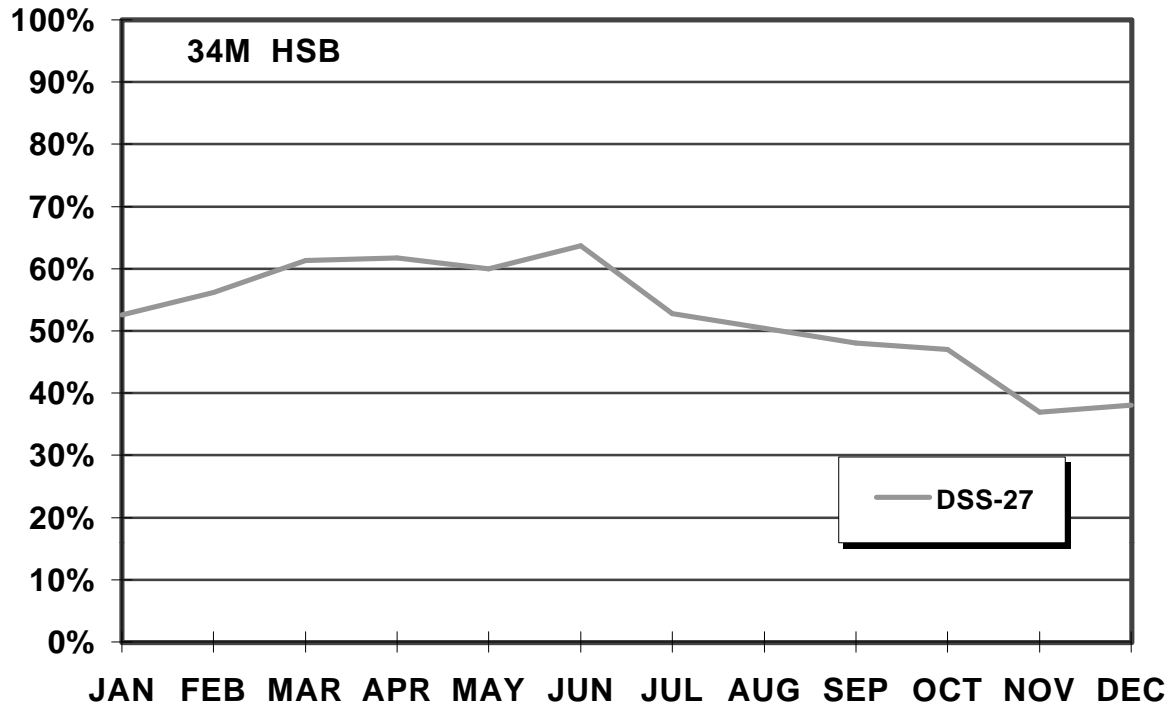


Figure 14d

Monthly Subnet Utilization 1999



MONTHLY SUBNET CAPACITY PROJECTION 2000

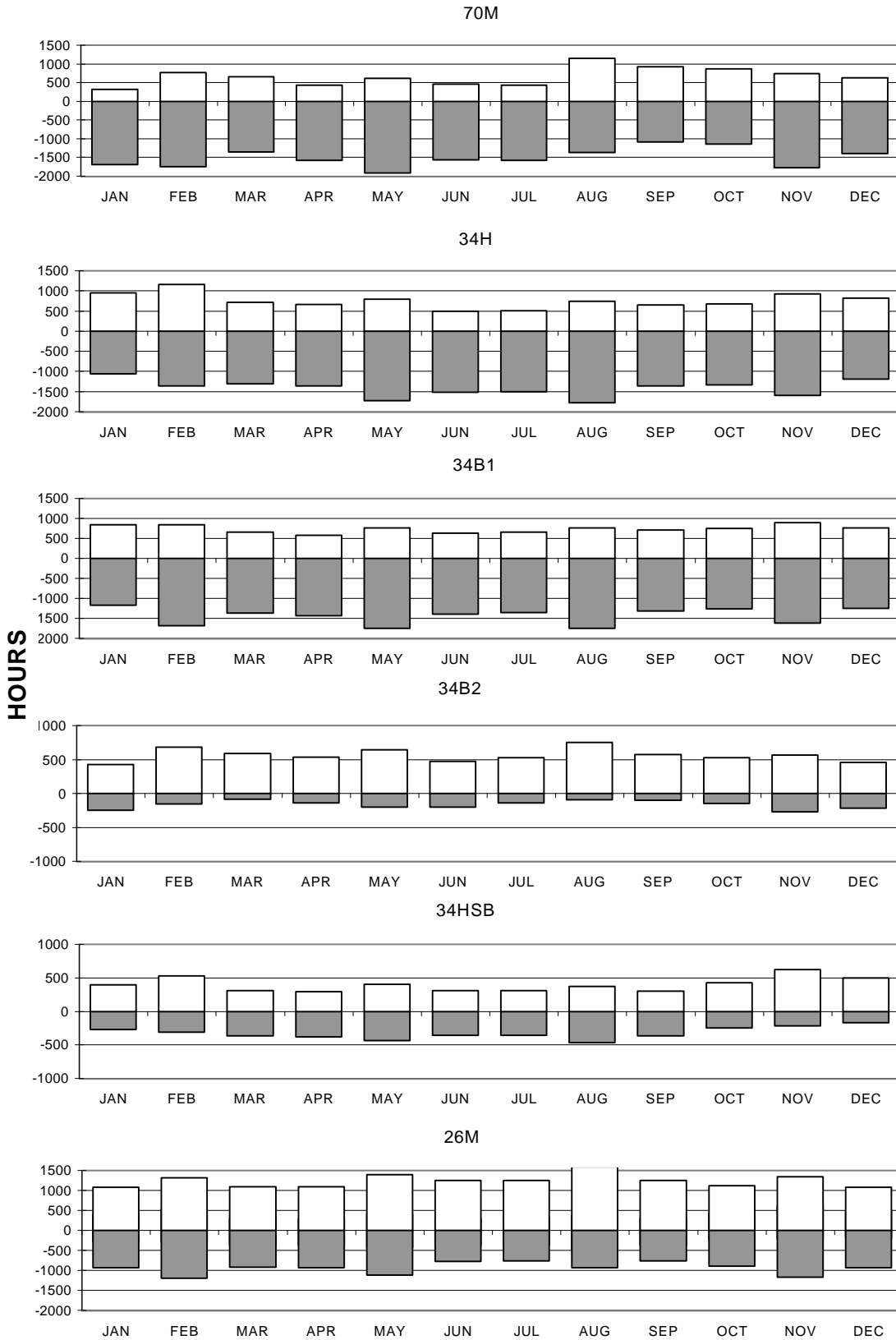


Figure 15

Monthly Subnet Utilization 2000

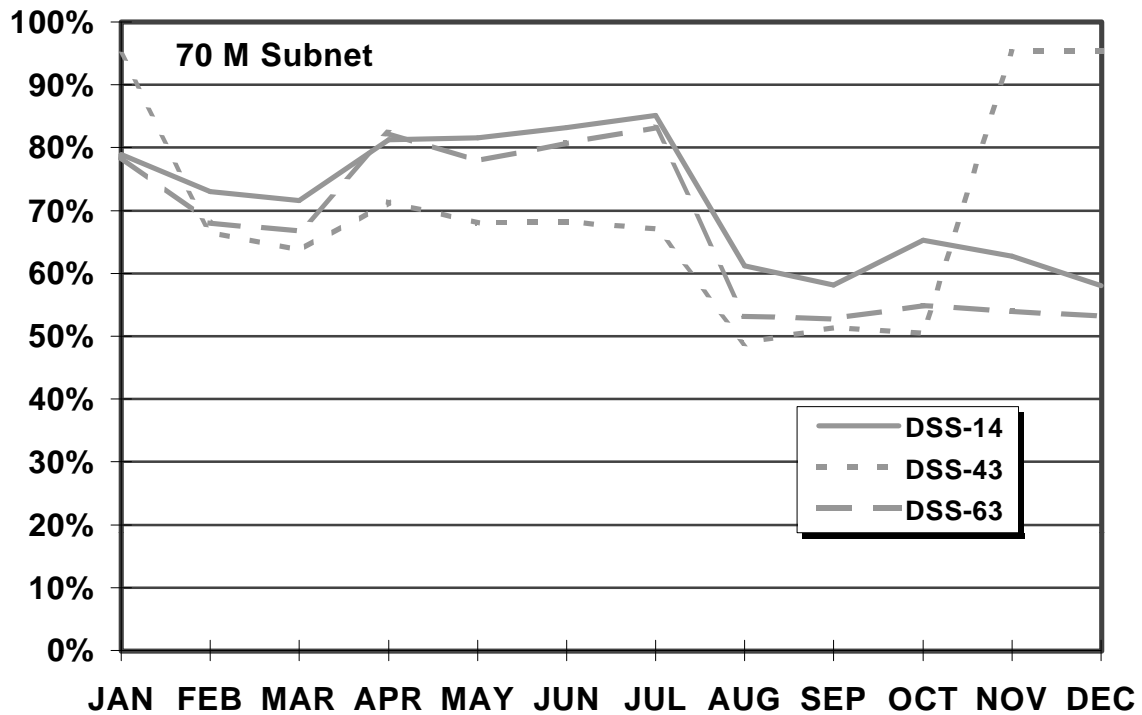


Figure 15a

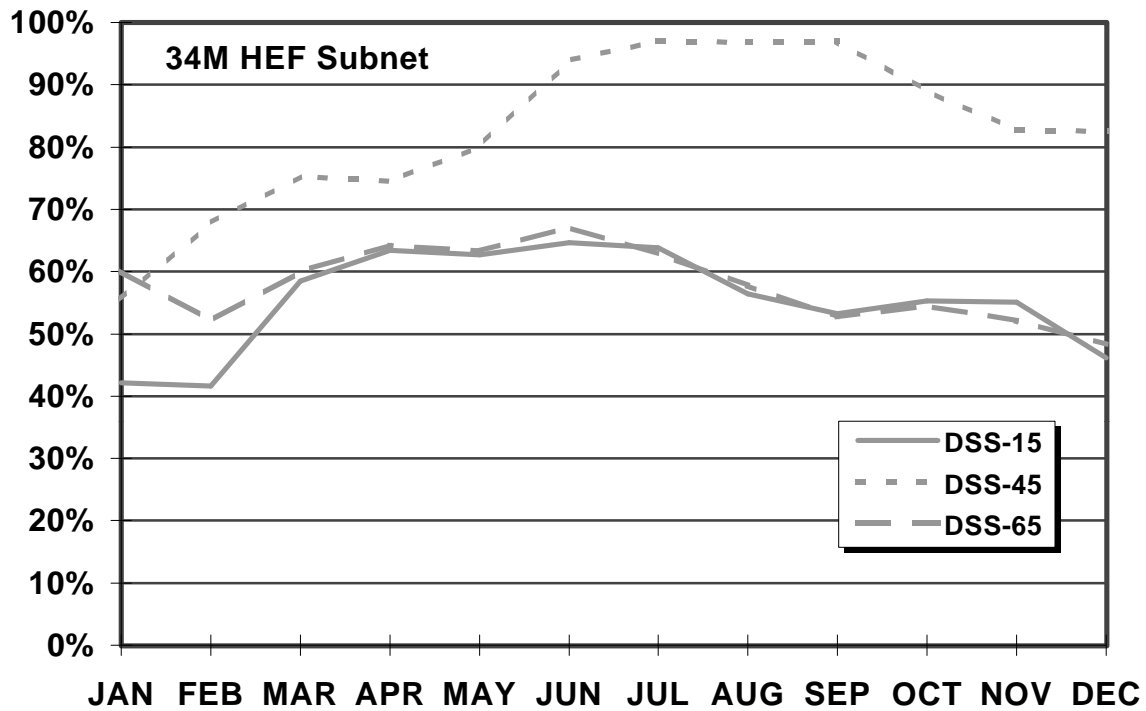


Figure 15b

Monthly Subnet Utilization 2000

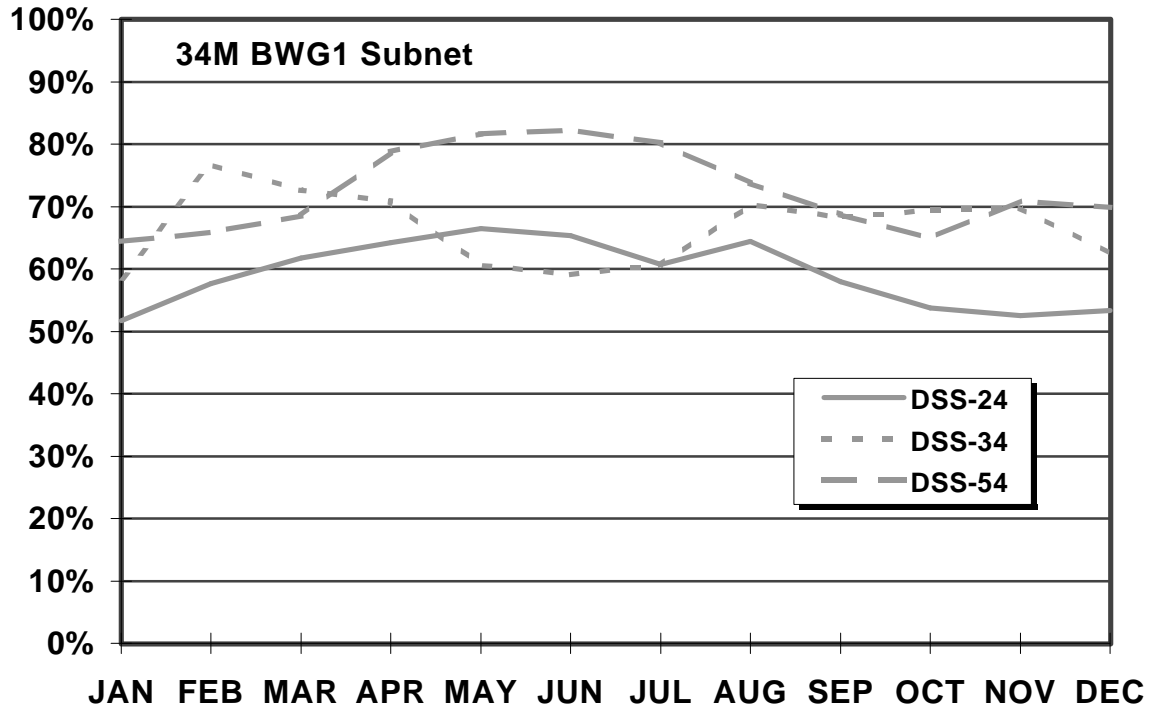


Figure 15c

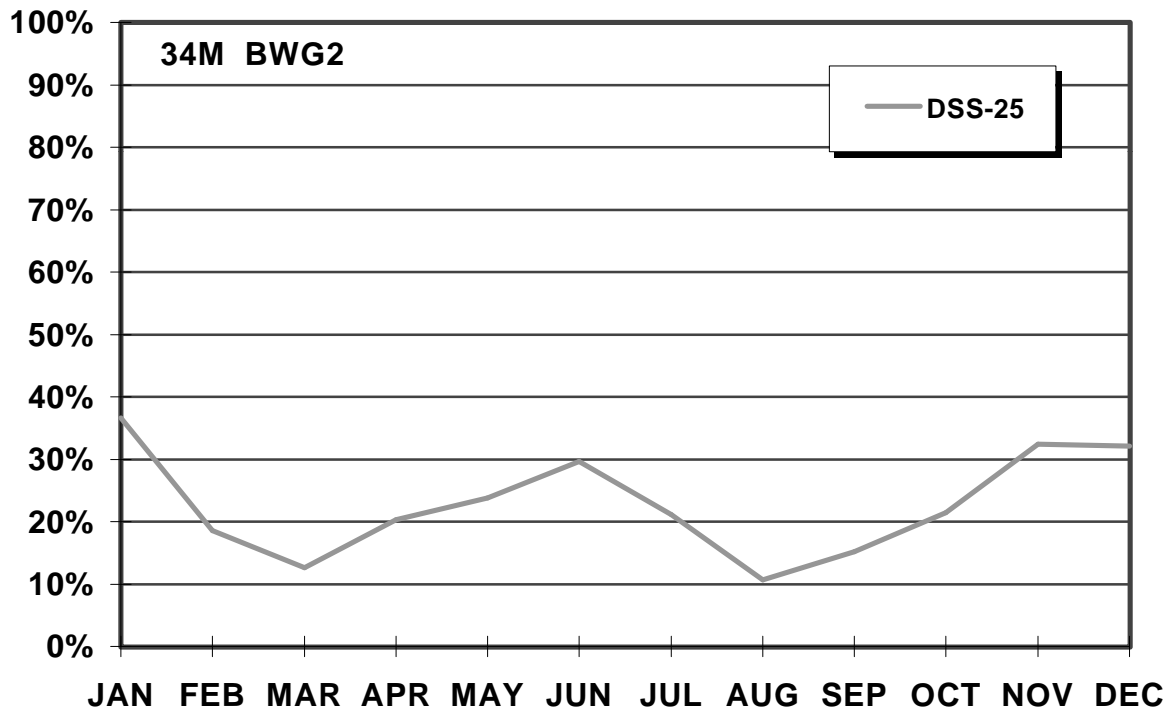
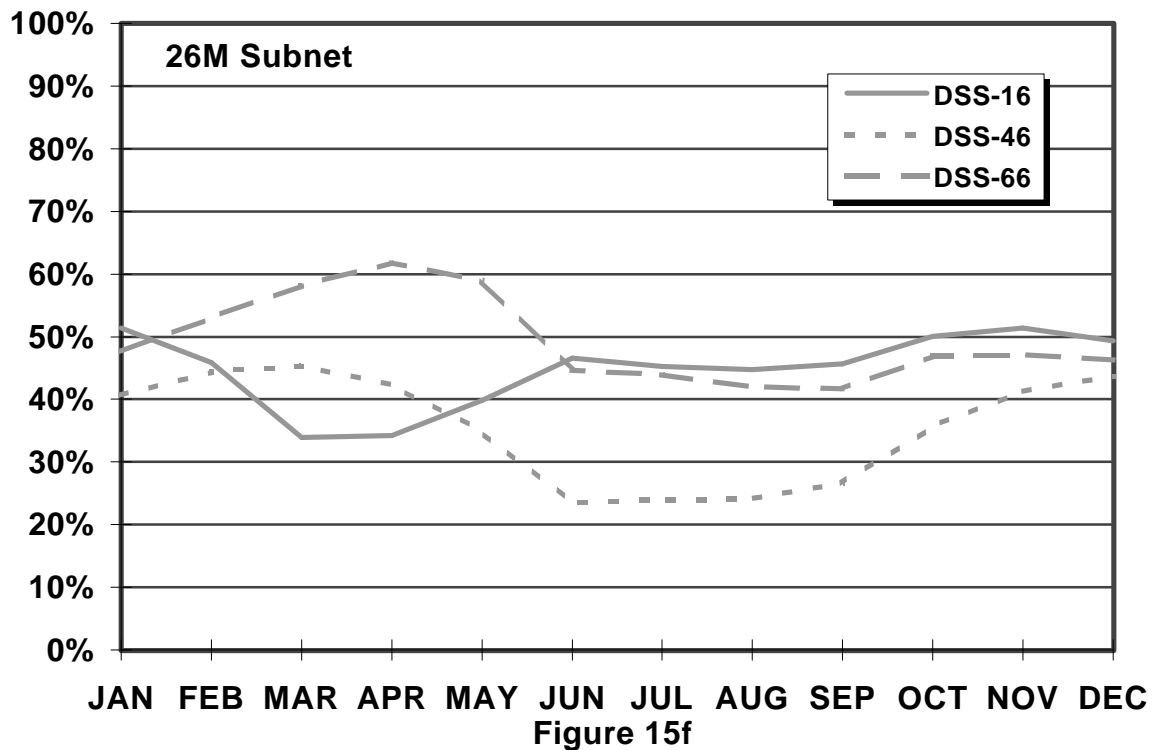
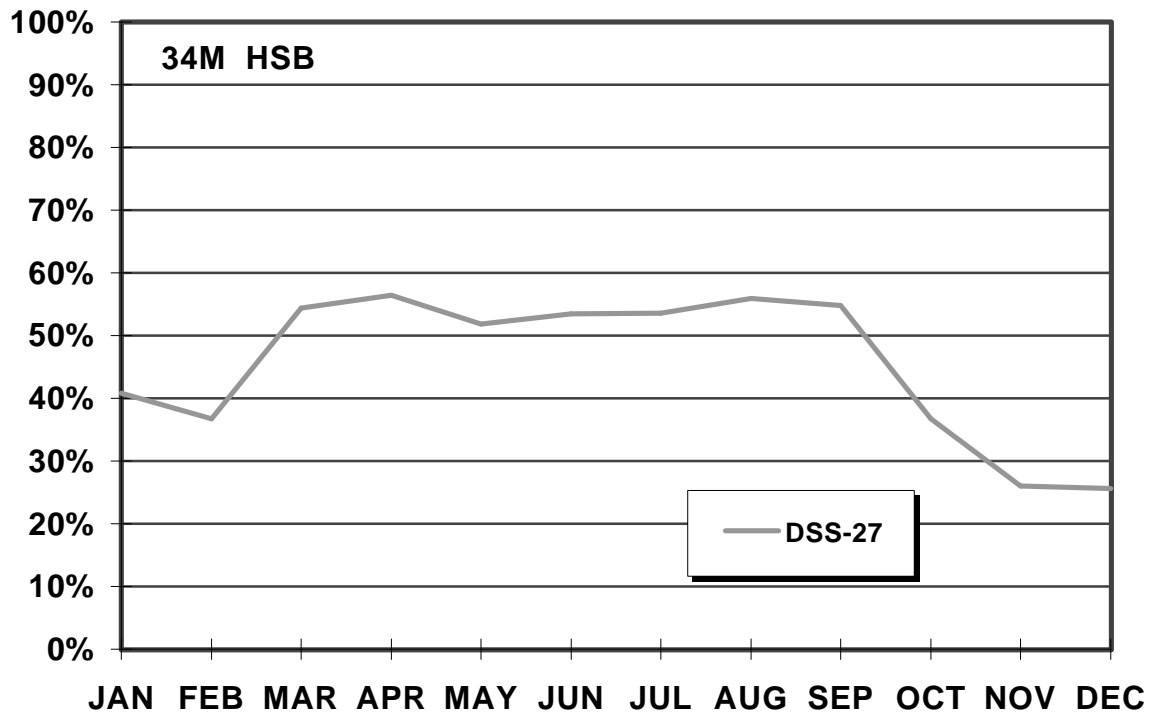
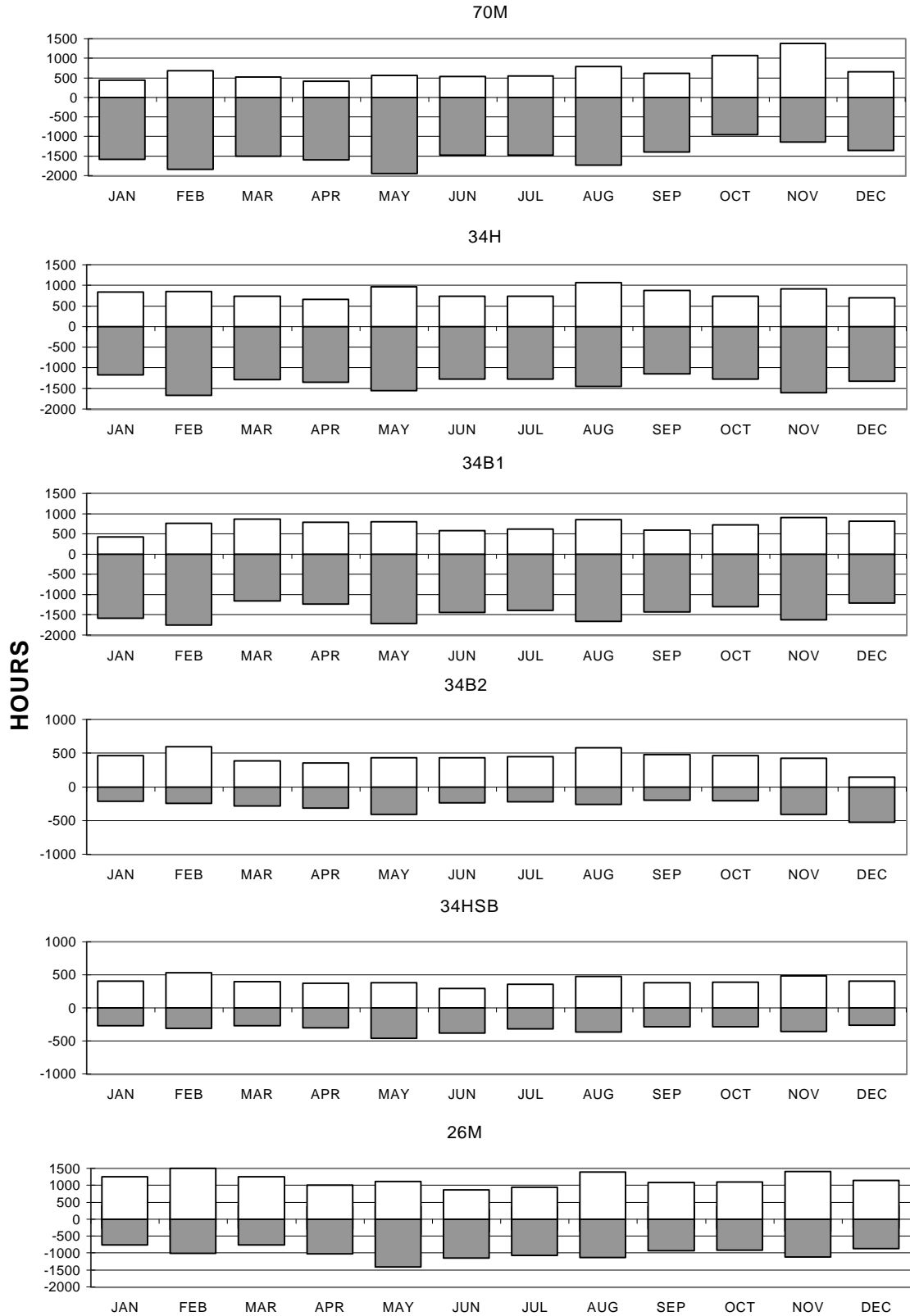


Figure 15d

Monthly Subnet Utilization 2000



MONTHLY SUBNET CAPACITY PROJECTION 2001



Monthly Subnet Utilization 2001

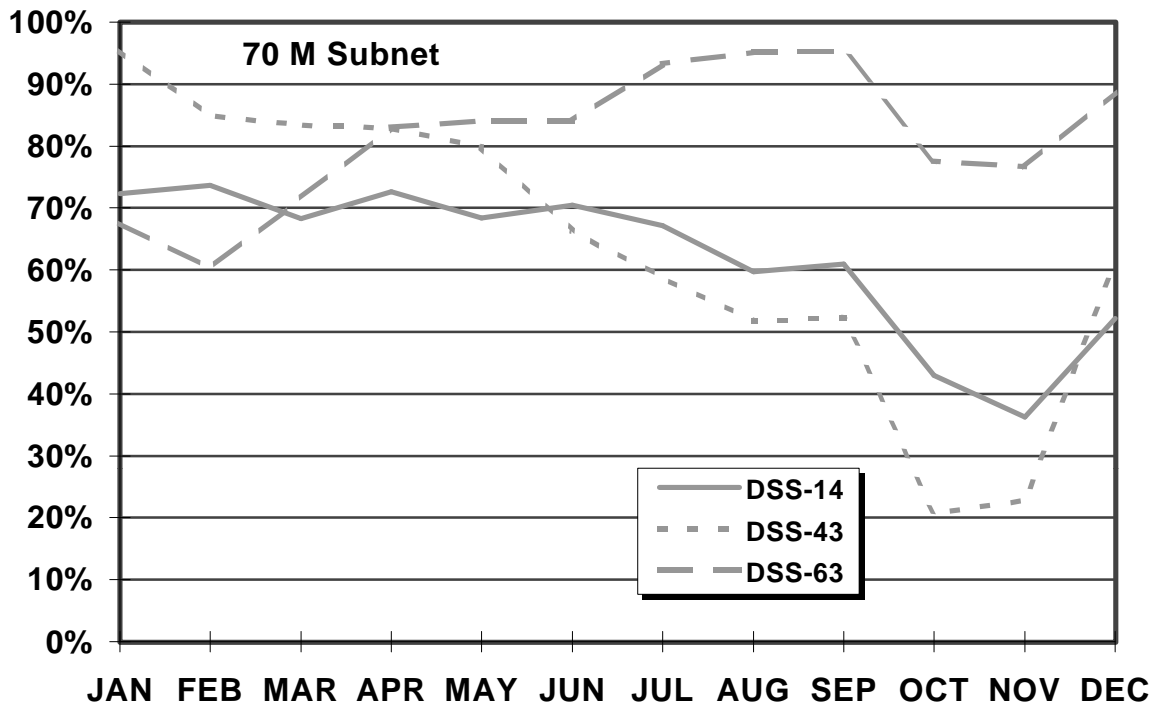


Figure 16a

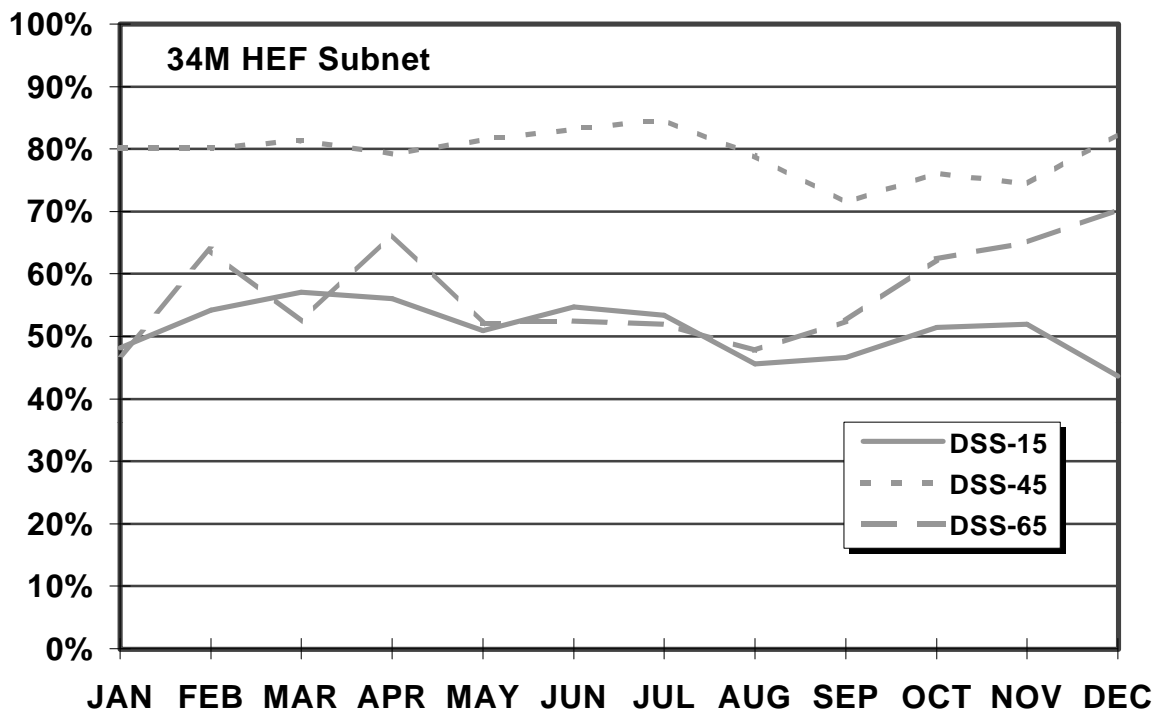
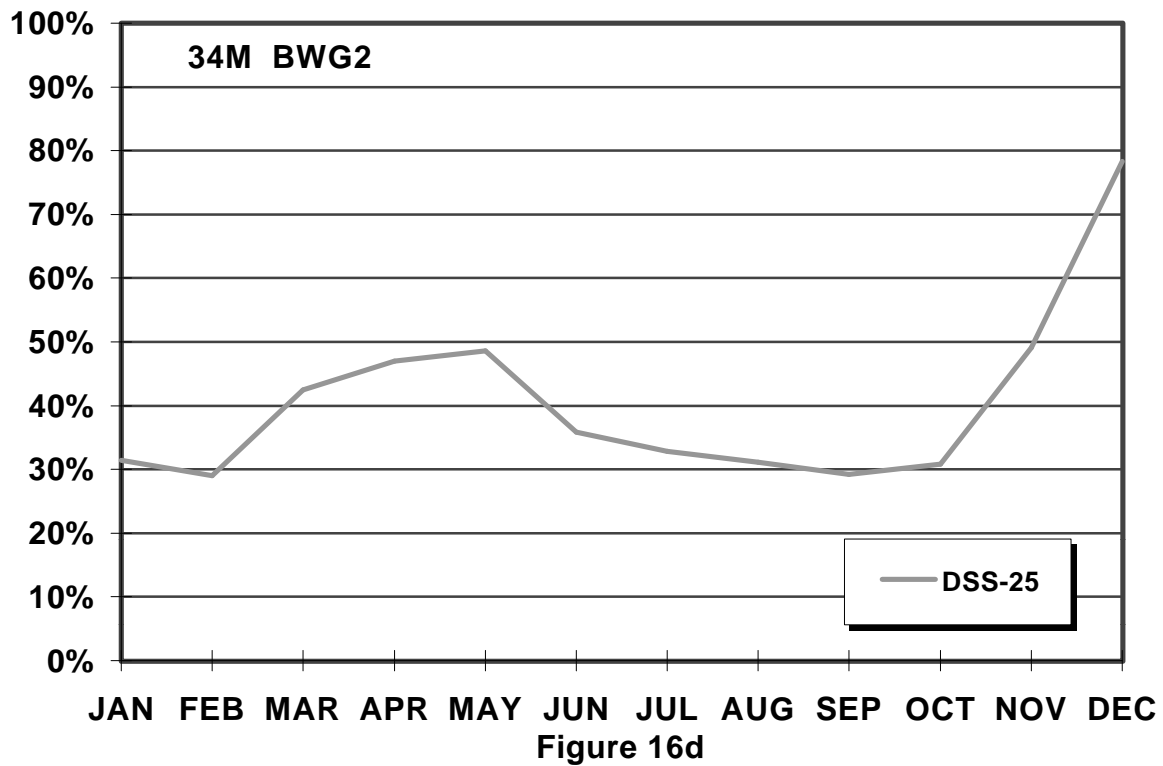
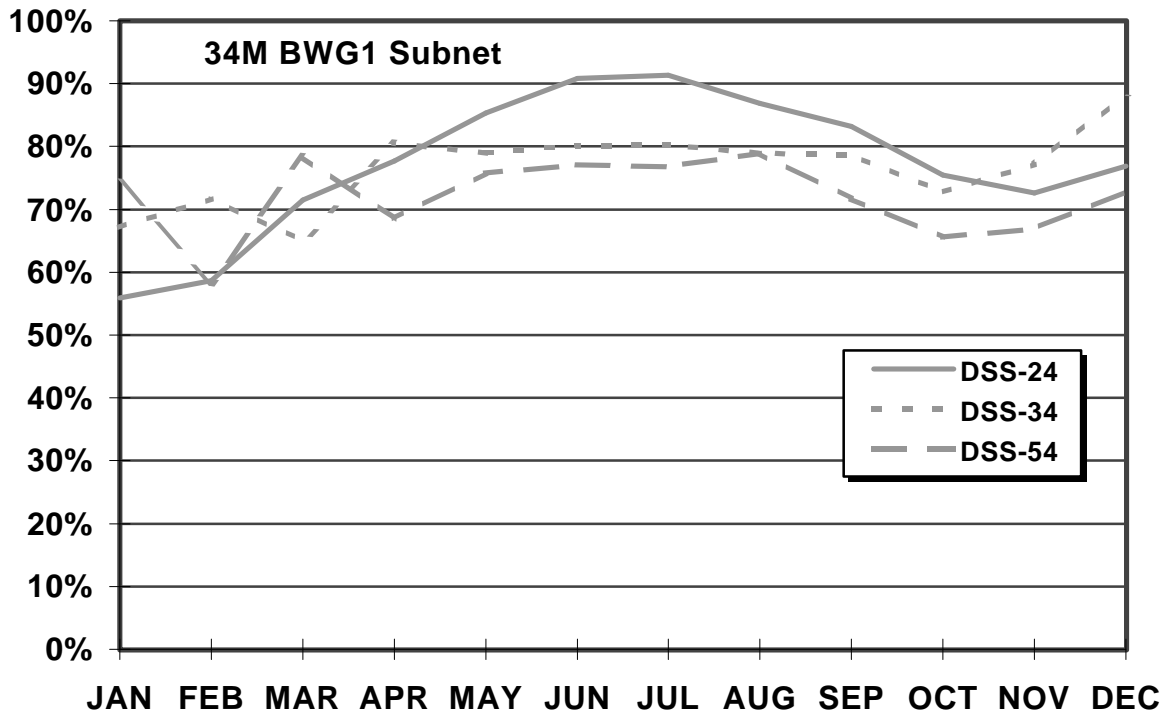
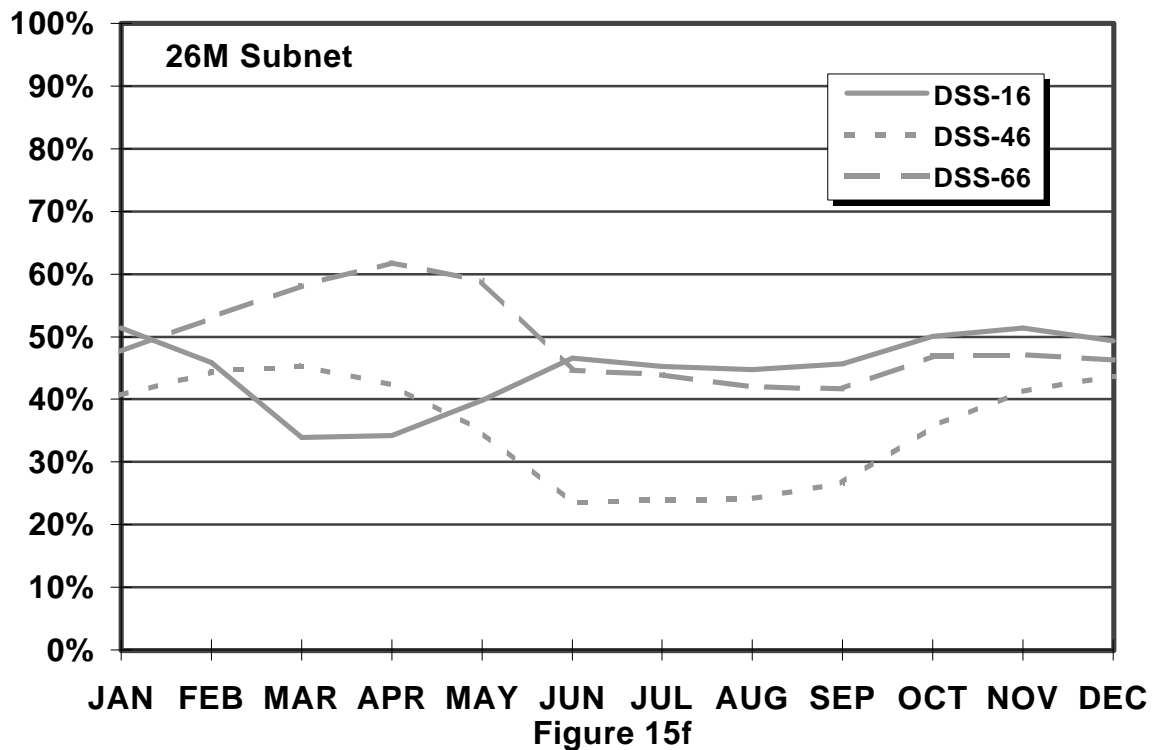
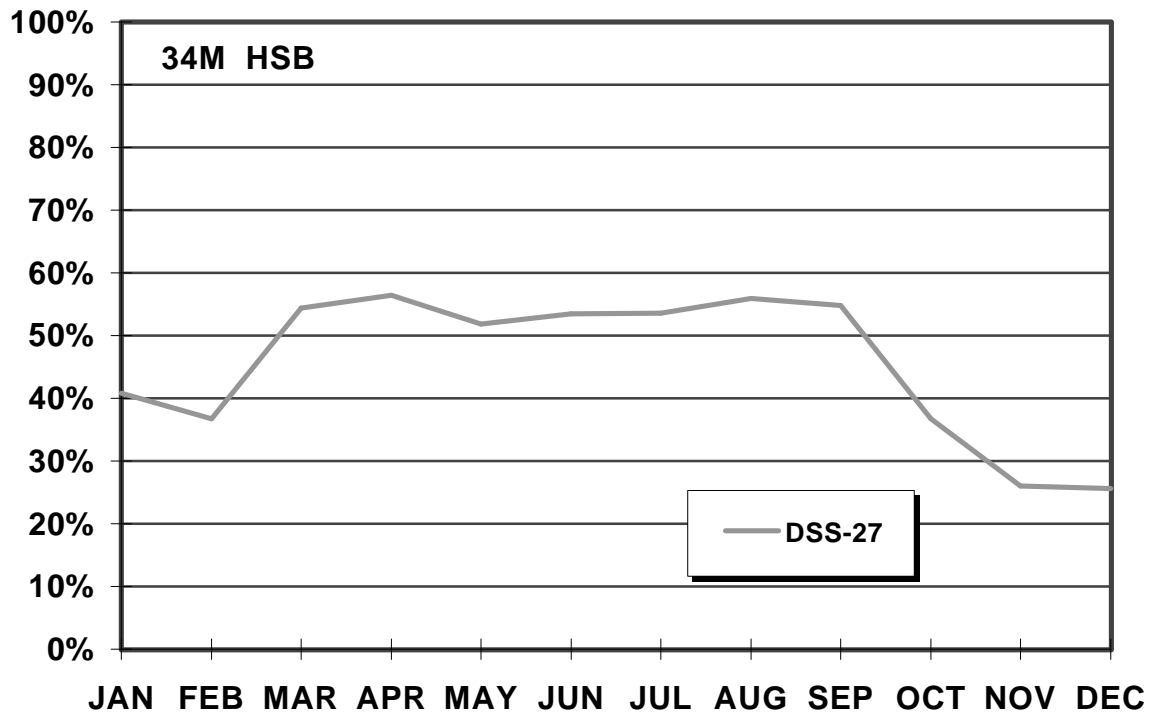


Figure 16b

Monthly Subnet Utilization 2001



Monthly Subnet Utilization 2000



LONG RANGE CAPACITY PROJECTION 2002 - 2008

